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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

AGGARWAL, YOGESH K

ART UNIT	PAPER NUMBER
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2615

DATE MAILED: 03/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/680,239

Applicant(s)

PAIN ET AL.

Examiner

Yogesh K Aggarwal

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) 3 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 October 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                                                        |                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                                            | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>6</u> . | 6) <input type="checkbox"/> Other: ____.                                                |

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 2, 4-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pain et al. (WO 99/48281) in view of Parker et al. (US Patent # 5,668,887).

[Claim 1]

Pain teaches the following:

An imaging device (figure 1: 10), comprising:

a photo-sensing array (figure 1: 15) of a plurality of sensing pixels (figure 1: 17) arranged in rows and columns, each pixel having a photo-sensing element to produce charge in response to incident photons from an object (Page 3, lines 15-17) and

an in-pixel circuit to convert said charge into an electrical pixel signal representing said charge (Page 1 lines 17-18, Page 3 lines 26-30)[The function of the amplifier is to convert the input charge into an electrical signal representing the charge]; and

an integrator array (figure 1: 30) of a plurality of integrators (figure 1: 35) arranged in rows and columns respectively equal to said rows and columns of said photo-sensing array (Page 4 lines 2-6),

wherein integrators (figure 1: 35) of each column are coupled to receive electrical pixel signals from only one designated column of sensing pixels in said photo-sensing array (figure 1: 15)

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[Figure 1 discloses an integrator 35 coupled to receive electrical pixel signals from one column of the photo-sensing array, Also see Page 4 lines 25-30]

Pain fails to teach the following: “and are operable to produce time-delayed integration signals representing the object after each sensing pixel is sampled and read out for a number of times equal to a number of said rows in said photo-sensing array”. However Parker teaches that these limitations are well known and used in the art to produce time-delayed integration signals representing the object after each sensing pixel is sampled and read out for a number of times equal to a number of said rows in said photo-sensing array (col. 2 lines 50-67, col. 3 lines 1-8, figure 1). Therefore taking the combined teachings of Pain and Parker it would have been obvious to one skilled in the art at the time of the invention to produce time-delayed integration signals representing the object after each sensing pixel is sampled and read out for a number of times equal to a number of said rows in said photo-sensing array. Doing so would prevent any smearing of the image features as taught in Parker (col. 3 lines 5-7).

[Claim 2]

The device as in claim 1, wherein each integrator in said integrator array includes capacitor-switched integrator (Pain, Page 4 line 21-22).

[Claim 3]

The device as in claim 2, wherein an operation of one integrator on a signal from one sensing pixel is temporarily overlapped with another operation of an adjacent integrator on another signal from a respective adjacent sensing pixel [It is obvious to one skilled in the art that when multiple exposure of the object takes place as taught in Parker (col. 3 lines 3-7) there is temporary

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overlapping of one integrator on a signal from one sensing pixel with an adjacent integrator on another signal from a respective adjacent sensing pixel in order to avoid smearing of images].

[Claim 4]

The device as in claim 2, wherein a single input terminal of said capacitor-switched integrator (Pain, figure 2A: op-amp A) is coupled to a first sampling capacitor (Pain, figure 2A: CMS) that stores a first signal from a first sensing pixel (Pain, figure 2A: 17) and a second sampling capacitor (figure 2A: CMR) that stores a second signal from a second sensing pixel (Pain, figure 2A: 17) adjacent to said first sensing pixel, said first and second signals being generated at different times (Pain, Page 5 lines 2-14).

[Claim 5]

The device as in claim 2, wherein said capacitor-switched integrator is a differential integrator (Pain, figure 2A: op-amp A) which has a first input terminal to receive an electrical pixel signal and a second input terminal to receive a reference signal (Pain, Page 4 lines 11-22, Page 5 lines 1-14)[The reset signal is read as a reference signal and other input through the capacitor CMS is for the electrical pixel signal].

[Claim 6]

The device as in claim 2, wherein said capacitor switched integrator includes a single-ended amplifier (Pain, figure 2A: op-amp A) whose output is coupled to a circuit having a reset sampling capacitor (Pain, figure 2B: CLR), an integrating capacitor (Pain, figure 2B: CLR), and a plurality of switches (Pain, figure 2B: MC9 and MC10), said switches positioned in said circuit to connect said reset sampling capacitor and said integrating capacitor (Pain, Page 4 lines 23-25).

[Claim 7]

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The device as in claim 1, wherein said in-pixel circuit includes an amplifier (Pain, Page 1 lines 17-18).

[Claim 8]

The device as in claim 1, wherein said photo-sensing element includes a photogate or a photodiode (Pain, Page 3 lines 26-27).

[Claim 9]

The device as in claim 1, wherein said sensing pixels are reset at the same time (Pain, Page 6 lines 25-26).

[Claim 10]

The device as in claim 1, further comprising at least one ADC coupled to digitize an output from said integrator array (Pain, Page 1 lines 20-22).

[Claim 11]

The device as in claim 1, wherein each sensing pixel is sampled for a first time to produce a reset value and for a second time after a photo-induced signal is generated to produce a signal value for each readout (Pain, Page 5 lines 2-14).

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claims 12-15 are rejected under 35 U.S.C. 102(a) as being anticipated by Pain et al. (WO 99/48281).

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[Claim 12]

An imaging device, comprising:

a substrate formed of a semiconductor (Page 2 lines 31-33, figure 1)[The APS imager 10 is formed on the same chip can be read as the whole APS imager formed on a substrate formed of a semiconductor]

a sensing array of active pixel sensors (figure 1: 15) in n rows and m columns fabricated on a first area of said substrate, operable to respond to photons to produce electrical pixel signals [Figure 1 discloses the sensing array formed on a first area of the substrate]; and an integrator array (figure 1: 30) fabricated on a second area of said substrate adjacent to said first area [The integrator array 30 is formed adjacent to the first area], said integrator array (figure 1: 30) having m amplifiers electrically coupled to said m columns of active pixel sensors [Figure 2A discloses one op-amp A in a column integrator] , respectively, wherein each amplifier is coupled to n pairs of capacitors (figure 2A: CMS and CMR) so that each pair of capacitors accumulate electrical pixel signals from n different active pixel sensors in a respective column that are generated at different times to produce a summed signal (Page 5 lines 2-14)

[Claim 13]

The device as in claim 12, wherein each amplifier samples each sensing pixel twice-during each readout to obtain a differential pixel signal between a reset value and a photon-induced signal value of said each sensing pixel (Pain et al., Page 5 lines 2-12).

[Claim 14]

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The device as in claim 13, wherein each pair of capacitors are coupled to a respective amplifier in a way that one capacitor receives said reset value and another capacitor receives said photon-induced signal value (Pain et al., Page 5 lines 2-12).

[Claim 15]

The device as in claim 14, wherein each amplifier is a differential amplifier which has a first input coupled to a designated column of active pixel sensors and a second input coupled to a reference (Page 5 lines 2-14)[The reset signal is read as a reference signal and other input through the capacitor CMS is for the electrical pixel signal].

6. Claims 16, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Parker et al. (US Patent # 5,668,887) in view of Pain et al. (WO 99/48281).

[Claim 16]

Parker teaches the following:

A method for imaging an object (figure 1: 52), comprising: using a linear sensing array of pixels (figure 1: 50) along a predetermined direction to capture radiation from the object (figure 1: 52) that moves relative to the sensing array along the direction (col. 2 lines 21-35, figure 1: 54'); and spatially shifting the mapping from the sensing array (figure 2: 50) to the integrator array (col. 2 lines 45-49, The shift register can be read as an integrator array) in sampling the different frames along the predetermined direction to produce a summed signal that sums pixel signals from different pixel locations of different frames corresponding to a common image from a location on the object (col. 3 lines 16-29). However Parker fails to teach the following: internally converting radiation-induced charge in each pixel of the array into an electrical pixel signal; coupling a linear integrator array of integrators to the sensing array to sample multiple frames of



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images of the object generated by the sensing array. Pain teaches that it well known and used in the art to convert internally the radiation-induced charge in each pixel of the array into an electrical pixel signal (Page 1 lines 17-18)[The function of the amplifier is to convert the input charge into an electrical signal representing the charge]; coupling a linear integrator array (figure 1: 30) of integrators (figure 1: 35) to the active pixel array. Therefore taking the combined teachings of Parker and Pain it would have been obvious to one skilled in the art at the time of the invention to have an amplifier that converts the radiation-induced charge in each pixel of the array into an electrical pixel signal by replacing the shift register in Parker with a linear integrator array of integrators to the sensing array 50 to sample multiple frames of images of the object generated by the sensing array. Doing so would be advantageous because the amplifier can buffer the photosignal as well as convert the charge from the CCD into an electrical pixel signal as taught by Pain (Page 1 lines 17-18).

[Claim 17]

The method as in claim 16, further comprising sampling each pixel twice in each frame to obtain a differential value between a reset level and a signal level of each pixel (Pain et al., Page 5 lines 2-12).

[Claim 19]

The method as in claim 16, wherein each integrator includes a switched-capacitor integrator (Pain, Page 4 line 21-22).

7. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Parker et al. (US Patent # 5,668,887) in view of Pain et al. (WO 99/48281) as applied to claim 17 above in further view of Hosier et al. (US Patent # 5,543,838).

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## [Claim 18]

Parker in view of Pain teaches the limitations of claim 17 but fails to teach, "... temporarily overlapping sampling a reset level of a first pixel and sampling a signal level of a second adjacent pixel." Hosier teaches that it is well known and used in the art to have overlapping sampling a reset level of a first pixel and sampling a signal level of a second adjacent pixel (col. 4 lines 38-47 figure 2)[During period S all pixels are reset and during period T they can start integrating again because the input of the amplifiers have been reset]. Therefore taking the combined teachings of Parker, Pain and Hosier it would have been obvious to one skilled in the art at the time of the invention to have overlapping reset level of a first pixel and a signal level of a second adjacent pixel. Doing so would allow a plurality of photodiodes to share one amplifier which results in a saving of the die area as taught in Hosier (col. 4 lines 65-66).

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yogesh K Aggarwal whose telephone number is (703) 305-0346. The examiner can normally be reached on M-F 9:00AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's primary examiner, Vu Le can be reached at (703) 308-6613. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4700.

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YKA

March 9, 2004

VULE  
PRIMARY EXAMINER